REMARKS

In view of the following discussion, the Applicants submit that none of the claims now pending in the application are made obvious under the provisions of 35 U.S.C. §103. The Applicants believe that all of these claims are now in allowable form.

I. REJECTIONS OF CLAIMS 1-14 UNDER 35 U.S.C. § 103

The Examiner rejected claims 1-14 under 35 U.S.C. §103 as being obvious over Gupta, Sandeep K.S. and Srimani, Pradip K. ("An Adaptive Protocol for Reliable Multicast in Mobile Multi-hop Radio Networks," (IEEE, 1999)) hereinafter referred to as "Gupta") in view of the Brady et al. patent (United States Patent No. 5,303,207, issued April 12, 1994, hereinafter referred to as "Brady"). In response, the Applicants have amended independent claims 1 and 14, from which claims 2-13 depend, in order to more clearly recite aspects of the present invention.

Gupta teaches a method for reconstructing a multicast tree that has become disconnected (*e.g.*, due movement of nodes in the network). The techniques disclosed by Gupta are built around core-based trees for each local region of the network. Specifically, in order to reconstruct the disconnected tree, a node both sends a multicasting message to nodes to which it is still connected via the tree and also floods a "forwarding region" comprising nodes that are not part of the tree with the message. At this point, only nodes in the forwarding region continue to forward the message. In this manner, the forwarding region of the network becomes flooded with the message, such that the message eventually reaches disconnected nodes that were previously part of the multicast tree.

Brady teaches an underwater acoustic local area network (ALAN) for oceanographic observation and data acquisition. The ALAN includes network nodes for telemetering data to a final destination and a plurality of sensor stations each having an acoustic modem for transmitting information to the network node. Thus, if a sensor station wishes to transmit information to the final destination (*e.g.*, a home station), the information is routed from the sensor station to the final destination over a virtual circuit

comprising paths established by one or more nodes. To facilitate this system, each of the nodes maintains a successor list table of proximal nodes that may serve as the node's successors. A node updates its successor list table by transmitting a loopback packet to another node and then computing the other node's distance based on parameters of the other node's response to the loopback packet.

The Examiner's attention is directed to the fact that Gupta and Brady, singly or in any permissible combination, fail to disclose or suggest a method and network whereby network topology information is globally updated across the nodes in the network when each node updates a respective table of network topology based on update messages that are distributed in accordance with path trees rooted at the sources of the update messages, as positively claimed by the Applicants. Applicants' independent claims 1 and 14 positively recite:

> 1. In a multi-hop network including a plurality of nodes that each maintains a table of network topology, a method for disseminating topology and link-state information over the multi-hop network, comprising:
>
> maintaining a path tree for each source node in the network that can produce an update message, each path tree having that source node as a root node, a parent node, and zero or more children nodes;
>
> receiving an update message from the parent node in accordance with the path tree maintained for the source node that originated the received update message, the update message including information related to a link in the network;
>
> updating the table of network topology in response to the information in the received update message; and
>
> forwarding the update message to children nodes, if any, in accordance with the path tree maintained for the source node that originated the update message in response to the information in the received update message, if it is determined that the update message should be forwarded to the zero or more children nodes, such that topology information for the network is globally updated across the plurality of nodes. (Emphasis added)

> 14. A network, comprising:
>
> a plurality of nodes in communication with each other over communication links, each node maintaining a table of network topology and a path tree for each source node in the network that can produce an update message, each path tree having that source node as a root node, a parent node, and zero or more children nodes,

> wherein one of the nodes (i) receives an update message from the parent node in accordance with the path tree maintained for the source node that originated the received update message, the update message including information related to a link in the network, (ii) updates the table of network topology in response to the information in the received update message, (iii) and forwards the update message to children nodes, if any, in accordance with the path tree maintained for the source node that originated the update message in response to the information in the received update message, if it is determined that the update message should be forwarded to the children nodes, such that topology information for the network is globally updated across the plurality of nodes. (Emphasis added)

In one embodiment, Applicants' invention teaches a method and network that uses the concept of reverse-path forwarding to broadcast each link-state in the reverse direction along a tree, e.g., using a tree formed by minimum-hop paths as an example. That is, each link-state update is broadcasted along the path rooted at the source node of the update. The minimum-hop-path trees (one tree per source) are updated dynamically using the topology and link-state information that is received along the minimum-hop-path trees themselves. Based on the information received along the minimum-hop-path trees, each node computes a parent node and children nodes, if any, for the minimum-hop-path tree rooted at each source node. Each routing node may receive and forward updates originating from a source node along the minimum-hop-path tree rooted at that source node. In this fashion, topology and link state information are disseminated globally, but without flooding the entire ad hoc network. (See Applicants' specification, page 16, line 3- page 23, line 3). The disseminated topology and link state information is used by nodes to update network topology tables that are maintained by each node.

By contrast, Brady teaches updating a successor list table by essentially "pinging" the nodes on the successor table list to determine their respective distances. This is not the same as receiving a message that includes update information in accordance with a path tree rooted at the source of the message. According to the present invention, a node need not actively seek out network topology updates or actively perform computations on received data in order to maintain its topology table; the updates are received as they are generated in accordance with the path tree. Thus,

a node can be substantially assured that its topology table is consistent with the most current topology information that is available.

As the Examiner acknowledges in the final office action that "Gupta does not specifically recite the existence of tables within the nodes for the storage of topology information", and as Brady clearly does not teach that network topology information is globally updated across the nodes in the network when each node updates a respective table of network topology based on update messages that are distributed in accordance with path trees rooted at the sources of the update messages, the Applicants respectfully submit that independent claims 1 and 14 are not made obvious by Gupta in view of Brady.

Moreover, as described in the response filed by the Applicants on November 22, 2005, Gupta teaches techniques that are built around core-based trees (*e.g.*, centered on a core router) for each local region of the network (*see*, *e.g.*, Gupta, Section 3.1: "Our protocol ... uses the concept of the core-based tree protocol ... Each multicast group has a unique multicast group identifier *gid* and has a unique *core* node", emphasis added). Traffic is sent and received over a single, shared tree regardless of source. Core-based trees are not the same as trees that are rooted at the source of an update message, as claimed by the Applicants.

Specifically, Gupta does not teach or suggest disseminating update messages that convey information about incremental changes in topology and link states (*e.g.*, without regard to actual data traffic) in accordance with an existing path tree rooted at the source of the update. At most, Gupta teaches that a first node wishing to join a multicast tree as a leaf node may send a join message to a second node in the multicast tree. The join message is processed by each node in the path from the source (*i.e.*, the first node) to the destination (*i.e.*, the second node). This path is determined hop-by-hop (*See*, Gupta, page 8, section 3.5). This stands in contrast to the Applicants' claimed invention, in which an update message containing information about link state or topology changes makes its way from source to destination(s) in accordance with an existing path tree rooted at and maintained for the source.

Additionally, Gupta does not teach globally updating network topology information across the nodes of the network. Rather, Gupta teaches core-based trees in multiple "regions" of a network. Thus, Gupta teaches a segmented network, whereas that taught by the Applicants is flat. Likewise, Brady also teaches a segmented network in which stations must communicate through intermediary hardware devices (nodes). Thus, as the Examiner has not provided any citation in Gupta for the teachings of an existing path tree rooted at and maintained for a source, and as Brady teaches a system that is likewise devoid of a preexisting path tree rooted at and maintained for a source, the Applicants respectfully submit that claims 1 and 14, as amended, fully satisfy the requirements of 35 U.S.C. §103 and are patentable thereunder.

Dependent claims 2-13 depend, either directly or indirectly, from claim 1 and recite additional features thereof. As such and for at least the same reasons set forth above, the Applicants submit that claims 2-13 are also not made obvious by the teachings of Gupta in view of Brady. Therefore, the Applicants submit that claims 2-13 also fully satisfy the requirements of 35 U.S.C. § 103 and are patentable thereunder.

II. CONCLUSION

Thus, the Applicants submit that none of the presented claims is made obvious under the provisions of 35 U.S.C. § 103. Consequently, the Applicants believe that all of the presented claims are presently in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issue are earnestly solicited.

If, however, the Examiner believes that there are any unresolved issues requiring the maintenance of the final action in any of the claims now pending in the application, it is requested that the Examiner telephone Mr. Kin-Wah Tong at (732) 530-9404 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

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